

CLAIMS

What is claimed is:

- Mark A2*
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1. An ultrasonic transducer, comprising:
 2. an ultrasonic sensor having a plurality of elements; and
 3. an integrated circuit formed on a wafer, the wafer including a plurality of cavities
 4. defining a plurality of posts such that the cavities alter the acoustic impedance of the
 5. wafer, and wherein the integrated circuit is joined to the ultrasonic sensor.

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1. 2. The transducer of claim 1, wherein the ultrasonic sensor comprises
2 piezoelectric ceramic material.

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1. 3. The transducer of claim 1, wherein the ultrasonic sensor comprises a
2 micro-machined ultrasonic transducer (MUT).

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1. 4. The transducer of claim 1, wherein each elements of the ultrasonic sensor
2 is located over one of the plurality of posts.

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1. 5. The transducer of claim 1, wherein each of the elements of the ultrasonic
2 sensor are located over one of the plurality of cavities.

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1. 6. The transducer of claim 1, wherein the cavities reduce acoustic energy
2 traveling laterally in the wafer.

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1. 7. The transducer of claim 1, wherein the wafer is silicon.

1 8. The transducer of claim 1, wherein the wafer is germanium.

1 9. The transducer of claim 1, wherein the cavities are designed to allow the
2 acoustic impedance of the wafer to match the acoustic impedance of the transducer
3 elements.

1 10. The transducer of claim 1, wherein altering the acoustic impedance of the
2 wafer increases the effective bandwidth of the transducer elements.
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1 11. The transducer of claim 1, wherein the wafer further comprises:
2 a first wafer component including the plurality of cavities; and
3 a second wafer component bonded to the first wafer component.

1 12. A method for forming an ultrasonic transducer, the method comprising
2 the steps of:
3 forming a plurality of cavities in a first wafer component such that the cavities
4 define the acoustic impedance of the first wafer component and such that the cavities
5 define a plurality of posts;
6 joining a second wafer component to the first wafer component;
7 forming an integrated circuit on a surface of the second wafer component;
8 forming an ultrasonic sensor having a plurality of elements; and
9 joining the ultrasonic sensor to the integrated circuit.

1 13. The method of claim 12, wherein the ultrasonic sensor comprises
2 piezoelectric ceramic material.

1 14. The method of claim 12, wherein the ultrasonic sensor comprises a
2 micro-machined ultrasonic transducer (MUT).

1 15. The method of claim 12, further comprising the step of locating each of
2 the elements of the ultrasonic sensor over one of the plurality of posts.

1 16. The method of claim 12, further comprising the step of locating each of
2 the elements of the ultrasonic sensor over one of the plurality of cavities.

1 17. The method of claim 12, wherein the cavities reduce acoustic energy
2 traveling laterally in the substrate.

1 18. The method of claim 12, wherein the first wafer component and the
2 second wafer component are silicon.

1 19. The method of claim 12, wherein the first wafer component and the
2 second wafer component are germanium.

1 20. The method of claim 12, wherein the first wafer component and the
2 second wafer component form an acoustically variable wafer.

1 21. The method of claim 20, further comprising the step of designing the
2 cavities to alter the acoustic impedance of the wafer to match the acoustic impedance of
3 the transducer elements.

1 22. The method of claim 20, further comprising the step of altering the
2 acoustic impedance of the wafer to increase the effective bandwidth of the transducer
3 elements.

1 23. An acoustically variable wafer, comprising:
2 a first wafer component having a plurality of cavities defining a plurality of posts
3 such that the cavities alter the acoustic impedance of the first wafer component ; and
4 a second wafer component bonded to the first wafer component , the first wafer
5 component and the second wafer component forming the wafer, where the wafer has a
6 variable acoustic impedance.

1 24. The wafer of claim 23, further comprising an integrated circuit formed
2 over a surface of the wafer.

1 25. The wafer of claim 23, further comprising a micro-machined ultrasonic
2 transducer formed over a surface of the wafer.

1 26. The wafer of claim 23, wherein the wafer comprises a circuit board.